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The Glosso-pharyngeal Nerve in the Domestic Cat.

By T. B. Stowell, A.M., Ph.D.

(Read before the American Philosophical Society, March 2, 1888.)

Introduction.—The following study in comparative neurology is a continuation of the contributions made by the author and already published in the Proceedings of the Society. [The Vagus Nerve in the Domestic Cat (Felis domestica), read July 15, 1881 ; The Trigeminus Nerve in the Domestic Cat, read May 21, 1886 ; The Facial Nerve in the Domestic Cat, read Nov. 5, 1886.] The object of these contributions has been presented in the previous papers.

I am not aware that any one has published the detailed distribution and relations of this nerve ; this study is therefore offered as a contribution to comparative neurology.

Preparation.—As previously recommended, the cats were injected with the "starch injection mass." The dissections have been verified upon alcoholic and upon recent specimens ; the nerves have been traced under a magnifying power of 15–25 diameters. It is hoped that such a degree of accuracy has been attained as will render this study serviceable to students of the nervous system.

DESCRIPTION.

Synonymy.—Nervus glosso-pharyngeus, N. pharyngo-glossus, Glosso-pharyngeal nerve, Eighth pair of cranial nerves (Willis), Ninth pair (Sommering).

General Characters.—The N. glosso-pharyngeus is the cephalic member of a group of nerves whose ectal origin is along a line caudad of the eminentia auditoria and dorsad of the area elliptica. The common niduses in man from which the ental fibres of these nerves arise have been designated the "nuclei of the lateral mixed system" (28, p. 747).

The N. glosso-pharyngeus is characterized by the presence of two ganglia upon the central portion of the nerve-trunk, the central one (Fig. Ehr.) is within the foramen of exit (Fm. jugulare), the peripheral one (Fig. Pe.) is about 7 mm. peripherad of the foramen. The presence of the root ganglion and the ental origin ally this nerve and the dorsal roots of the myelic nerves.

The glosso-pharyngeus is specifically the sensory nerve of the pharynx, of the mucosa of the tympanum, and of the basal (circumvallate ?) papillæ of the tongue. It includes motor fibres which are given to the cephalic pharyngeal constrictor and to the stylo-pharyngeus muscles. Communicating rami connect the N. glosso-pharyngeus with the N. vagus, the N. sympathicus, the G. oticum, and with the N. facialis.

The glosso-pharyngeus is peculiarly the nerve of deglutition as well as the nerve of taste. The importance of having these functions associated in the same nerve appears when the relation of food-stuffs to life is considered. The inverted muscular reaction which ensues upon the application of an unnatural or irritating stimulus is another characteristic of this nerve.

The conflicting evidence of Bell, Longet, Panizza, Reid, Mayo, Bernard, Chauveau, and other experimenters, leaves grave doubt as to the susceptibility of the N. glosso pharyngeus to receive painful impressions.

I am not aware that the function of the tonsillar branch has been demonstrated.

Ectal Origin.—The ental roots (5–6 funiculi) constitute a small nerve-trunk whose ectal origin is in the depression line dorsad of the oliva, the line of origin of the dorsal roots of the N. vagus [indeed, the cephalic funicle of the vagus seems to belong to the root funiculi of the glosso-pharyngeus]. The trunk so formed lies ventrad of the plexus choroideus lateralis and passes laterad to the foramen of exit.

Foramen of Exit.—The nerve takes its exit from the cranium through the foramen jugulare in connection with the vagus and the accessorius nerves, the jugular vein, and a small arteriole from the A. occipitalis.

Intercranial Course and Root Ganglion.—In the passage through the jugular fossa the sheath of the N. glosso-pharyngeus is distinct from and cephalad of the common sheath of the vagus and the accessorius and is separated by the arteriole above referred to. At the central end of the fossa the N. pharyngeus bears a small pinkish ganglion (G. ehrenritteri, G. nervi glosso-pharyngei superius, G. jugulare superius, G. mulleri). This ganglion lies upon the ectal surface and the ventral border of the G. jugulare of the N. vagus, but it does not appear to have structural relations with the ganglion. The ganglion (G. Ehr.) is ectal and does not involve all of the fibres of the trunk.

Plexus gangliformis, Pl. nodosus.—The central 5 mm. of the ectocranial trunk are closely apposed to, if not involved in the somewhat intricate net-work of vessels and tissues which characterize this region and form the gangliform or nodose plexus (Fig. Gang.). The apposed trunks of the glosso pharyngeus, the vagus, the accessorius, the hypoglossus, and the sympathic nerves by a peculiar interlacing of fibres and by anastomotic rami sustain intimate inter-relations. There is reason for thinking that through this plexus, the glosso-pharyngeus is connected with the accessorius (the complications involved in identifying rami in this plexus leave some doubt regarding the precise structure of this plexus). The glosso-pharyngeus is ectal in this group and is possibly separable from the ental nerves.

G. petrosum and its Communicating Rami.—At the caudal border of the plexus gangliformis the glosso-pharyngeus presents a fusiform enlargement, the ganglion petrosum (Fig. Pe.), ganglion of Andersch. This is the ganglion of the trunk and is about 2 mm. × 1 mm.; it seems to involve the entire nerve-trunk. Its communicating rami are five, as follows:

1. A large ramus to the dorso-cephalic border of the G. inferius of the N. vagus (Fig. 2). 2. A small ramus to the adjacent sympathic ganglion (G. cervicale cephalicum, Fig. 1). 3. A branch to the plexus, some fibres of which are apparently traceable to the N. accessorius, in the second or large accession from that nerve to the vagus (Fig. 3). 4. A slender filament (Fig. 4) to the auricular branch (Fig. Aur.) which joins the jugular ganglion of the vagus with the geniculate ganglion of the facialis. The auricular ramus crosses the ectal surface of the glosso-pharyngeus just peripherad of the G. ehrenritteri and receives the anastomotic filament from the G. petrosum at a point opposite the nerve-trunk (this filament is frequently broken in dissecting the plexus). These four rami are given off from the ental surface of the G. petrosum as a single trunk or as several closely apposed rami. 5. A large branch, the tympanic (Fig. Tym.) which lies in a fossa entad of the ectal bulla together with a branch from the sympathic. This branch divides in the fossa, into four ramuli, as follows: *a.* One (Fig. Pe. maj.) becomes one of the roots of the great superficial petrosal, which in turn is one of the roots of the vidian nerve. *b.* A second (Fig. Pe. min.) is one of the roots of the small superficial petrosal and terminates in the otic ganglion. *c.* A third (Fig. Eus.) forms a plexus around the eustachian tube. *d.* The fourth (Fig. Pl. tym.) forms, with the sympathic, the tympanic plexus upon the ectal surface of the promontory, from which filaments are traceable to the fenestra rotunda and the F. ovalis.

Principal Rami.—Peripherad of the G. petrosum the nerve-trunk bends around the ventral surface of the ectal bulla and lies apposed to an arteriole, a ramulus from the A. occipitalis. 8 mm. peripherad of the ganglion it gives the first ramus of the trunk (Fig. car.), caudad to the plexus carotideus about the ectal origin of the A. occipitalis. 6 mm. peripherad of this ramus, a branch is sent dorsi-mesad to the sphincter muscles of the pharynx (Fig. M. phar.)—this ramus seems to be the only distinctively muscular branch of this nerve ; filaments are also given to the M. stylopharyngeus. It is through this ramus that the N. glosso-pharyngeus controls deglutition (the palatal branch, q. v., may possibly reach muscular fibre in the palatal region, corresponding to the M. palato-glossus, and the M. palato-pharyngeus. I have not satisfactorily identified these muscles).

N. pharyngeus.—At the origin of the muscular ramus just described a large ramus, N. pharyngeus (Fig. Phar.), is directed ventrad and caudad ; this ramus, about 5 mm. peripherad of its origin, divides into two ramuli, the cephalic one (Fig. Pal.) is distributed to the pharynx in the palatal region ; the caudal ramulus forms a dense plexus (Fig. Pl. Phar) with the pharyngeal branch of the vagus nerve (Fig. Phar. Vagus) upon the pharyngeal mucosa laterad of and adjacent to the epiglottis.

A second pharyngeal ramus (Fig. Phar. muc.) is given off 10 mm. peripherad of the first ; this is distributed to the mucosa laterad of the base of the tongue. A third branch is given off about 5 mm. still peripherad, which unites in the pharyngeal plexus upon the mucosa.

N. tonsillaris.—About 10 mm. peripherad of the first R. pharyngeus a ramus (Fig. Ton.) is given to the tonsil and to its enveloping capsule. The function of this nerve is not known.

N. papillaris.—The terminal filaments (Fig. Papillæ) may be traced to the long papillæ (circumvallate ?) 15 mm. peripherad of the Os hyoides, upon the base of the tongue. These filaments are in the most restricted sense, the nerves of taste.

SUMMARY.

A. ANATOMICAL.

Ectal Origin.—By 5–6 funiculi in the depression line caudad of the eminentia auditoria, dorsad of the oliva and cephalad of the dorsal roots of the N. vagus.

Foramen of Exit.—Foramen jugulare.

Intercranial Course.—In the passage through the jugular fossa, the N. glosso-pharyngeus is the cephalic one of the structures which traverse the foramen. At the central end of the fossa, the nerve bears a ganglion, the G. ehrenritteri, which is ectal in position and does not involve the entire trunk.

Ectocranial Trunk.—The first 5–7 mm. of the ectocranial trunk are intimately associated with the plexus gangliformis which involves the central portions of the vagus, the accessorius, the hypoglossus, and the sympathic nerves, from which plexus it is generally distinct, although it contributes a considerable ramus (possibly this is an accession to the glosso-pharyngeus from the accessorius). 7 mm. peripherad of the foramen of exit the nerve is involved in a small fusiform ganglion.

G. petrosum and its Communicating Rami.—This fusiform ganglion involves the entire nerve-trunk; it is easily overlooked in the enveloping connective tissue and the adjacent plexus. From its ental surface a single trunk or four adjacent anastomotic rami take their ectal origins as follows: the ventral one to the cephalic cervical ganglion of the N. sympathicus; one just caudad and the largest joins the G. inferius of the vagus nerve; dorsad of this ramus the second in size is given to the plexus gangliformis, a portion of which seems to be traceable to the N. accessorius; the dorsal slender filament joins the ramus auricularis from the root ganglion, G. jugulare, of the vagus to the geniculate ganglion of the N. facialis. From the cephalic border of the ganglion the large tympanic branch, or Jacobson's nerve, lies in a fossa entad of the ectal bulla tympanica adjacent to a branch from the cervical sympathic ganglion. The tympanic nerve divides into four branches as follows: one of the roots of the great superficial petrosal nerve, the principal root of the small petrosal nerve which terminates in the otic ganglion, a slender filament which joins the eustachian plexus, and the branch to the tympanic plexus.

Principal Rami.

1. *Muscular;* a branch to the pharyngeal constrictor muscles (Fig. M. Phar.) has its ectal origin about 14 mm. peripherad of the G. petrosum.

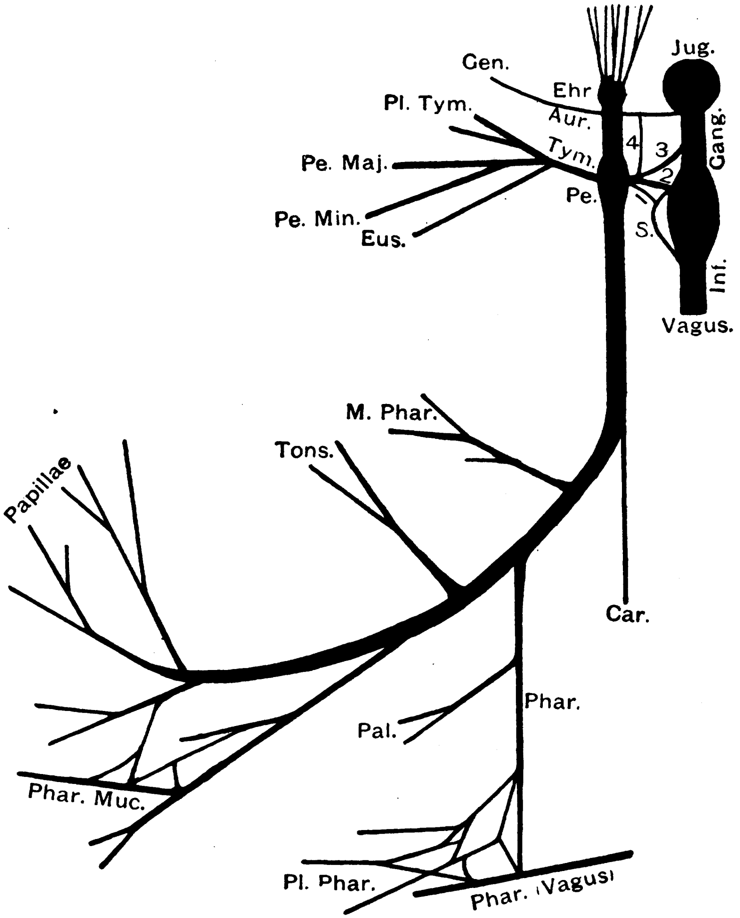

Diagram of the Glosso-pharyngeal Nerve.—Stowell.

2. *Pharyngeal;* three rami from the ventral border of the nerve-trunk to the pharyngeal mucosa.

3. *Tonsillar;* a branch, 10 mm. peripherad of the muscular ramus, to the tonsil and its enveloping capsule.

4. *Terminal;* to the long papillæ at the base of the tongue.

5. *Communicating and anastomotic;*

At the G. petrosum with the G. cervicale cephalicum (sympathicus).
" " " " G. inferius (vagus).
" " " " plexus gangliformis.
" " " " R. auricularis.
" " " it is the origin of the tympanic nerve (Jacobson).
To the plexus carotideus at origin of the A. occipitalis.
In the plexus pharyngeus with the N. pharyngeus (vagus).

B. PHYSIOLOGICAL.

The N. glosso-pharyngeus is the sensory nerve of the pharynx; it is the special sense nerve of taste; it controls deglutition, and when abnormally irritated excites an inverted muscular action in the muscles of the stomach and œsophagus, inducing vomiting; it does not seem to be susceptible of painful sensations.

EXPLANATION OF THE DIAGRAM.

The diagram is not drawn to a scale. It has been the author's aim to present in definite form the principal structures and relations, combining simplicity and clearness. Aur., the auricular branch from the jugular ganglion of the vagus nerve to the geniculate ganglion of the facial. This nerve crosses the ectal surface of the glosso-pharyngeus just ventrad of the root ganglion. Car., the anastomotic nerve to the carotid plexus around the ectal origin of the A. occipitalis. Ehr., the ganglion Ehrenritteri, or ganglion of the root. Eus., the branch which forms with the sympathic a plexus upon the eustachian tube. Gang., the plexus gangliformis, or plexus nodosus. Gen., the position of the geniculate ganglion of the facial nerve. Inf., the ganglion inferius or ganglion of the trunk of the vagus nerve. Jug., the ganglion jugulare or root ganglion of the vagus. M. phar., the muscular ramus to the pharyngeal constrictors. Pal., the branch of the pharyngeal nerve which is distributed to the mucosa in the region of the soft palate, and possibly to the palatal muscles. Papillæ, the terminal filaments of the papillary ramuli which are given to the long papillæ characteristic of the dorsal surface of the base of the tongue. Pe., the ganglion petrosum or ganglion of the trunk. Pe. maj., the branch of the tympanic nerve which becomes one of the roots of the great superficial nerve. Pe. min., the branch of the tympanic which becomes the small petrosal nerve and terminates in the otic ganglion. Phar., the pharyngeal ramus which joins the pharyngeal nerve from the vagus to form the pharyngeal plexus. Phar. muc., the rami which form the plexus over the pharyngeal mucosa. Phar. vagus, the N. pharyngeus, a branch of the vagus. Pl. phar., the plexus pharyngeus. Pl. tym., the tympanic plexus over the promontory of the tympanum. S., the cephalic cervical ganglion of the sympathic, ganglion, just entad and cephalad of the G. inferius. Ton., the tonsillar branch. Tym., the tympanic ramus or Jacobson's nerve. Vagus, the central 10 mm. of the vagus nerve, showing the relations of the ganglia. 1. Anastomotic filament from G. petrosum to S. 2. Communicating branch to the G. inferius. 3. Branch to the plexus gangliformis ; this is the doubtful accession from the N. accessorius. 4. Anastomotic filament to the R. auricularis.

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The Accessory Nerve in the Domestic Cat. By T. B. Stowell, A.M., Ph.D.

(Read before the American Philosophical Society, March 2, 1888.)

Synonymy.—N. accessorius ; Accessory of the Par Vagum ; Accessory nerve of Willis ; Spinal accessory ; Superior respiratory ; Eleventh pair of encephalic nerves.

General Characters.—This nerve is called accessory because of its large accessions to the N. vagus, in the G. jugulare and in the plexus just peripherad, v. description below ; it is called myelic and spinal from the fact of its widely distributed origin along the cervical myel, v. below. The nerve is an attractive study alike to the anatomist and to the physiologist ; its origin, distribution, terminal plexuses and its action upon respiratory movements, laryngeal phonation and the heart are equally distinctive. It combines a large group of myelic funiculi with a few from the medulla ; by virtue of its accessions to the Vagus it sustains structural relations with the N. pharyngeus and with the N. laryngeus caudalis (Rami of the Vagus), indeed a large share of the motor fibres of the Vagus is referable to the accessions from the Accessorius [Longet, Système Nerveux, t. ii, p. 265 ; Cl. Bernard, Leçons sur la Physiologie du Système Nerveux, t. ii, p. 244] ; by an anastomotic ramus it joins the N. hypoglossus, and in its terminal filaments it makes numerous plexuses with the cervical myelic nerves. M. Claude Bernard by his method of evulsion demonstrated that laryngeal phonation is due to the action of the accessory nerve. The prolonged cries of many mammals seem to confirm his conclusions and are due, in part, at least, to the rigidity of the cervical muscles in sustained expiratory movements. According to Heidenhain, this accession gives cardio-inhibitory fibres to the Vagus.